

**REMARKS**

The Office Action dated March 3, 2004, and cited references have been carefully reviewed. Claims 1-31 remain pending and are at issue. The originally filed claims were numbered incorrectly in that there were two claims numbered 6. The claim numbering has been corrected in this Office Action. In the remarks that follow, the correct claim numbers are used. Claims 1, 2-7, 10-12, 15-16, and 28-29 have been amended. The specification has been amended to add new FIG. 9c and corresponding text. No new matter has been added since the figure and text are supported by the claims and the original specification. The Examiner is respectfully requested to approve these amendments.

***Drawing Objections***

The Examiner has objected to the drawings and has stated that the details in Figs. 2-4, 9a and 9b cannot be clearly seen due to the quality of the drawings. The Examiner has also stated that the stress relief at a base and the lateral stress relief must be shown or the features canceled from the claims.

The Examiner is requested to approve the accompanying replacement drawings. The changes to the drawings are to change the figures from photographs to drawings. The lateral stress relief is already shown in the drawings as windows. The strain relief is shown in exploded view in new Fig. 9c. The relief can be seen in the original photographs. The Examiner is respectfully requested to approve these drawings and withdraw the objection to the drawings.

***35 U.S.C. §112 Rejections***

The Examiner has rejected claims 2-7, 10-12, 15, 16, 28, and 29 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Examiner has stated that the claims are incomplete for not defining the variables used in the claims. While this requirement is not believed to be necessary since the variables are defined in the application, these claims have been amended to define the variables. These amendments do not change the scope of the claims.

The Examiner has rejected claim 24 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Examiner has stated that Applicant should clarify what is meant by a “Multi-User Micro-Electro-Mechanical System Process.” The

Applicants respectfully disagree. An Applicant is not required to explain what is well known in the art. The Multi-User Micro-Electro-Mechanical System Processes, also known in the art as Multi-Users MEMS Processes (abbreviated as MUMP) is a standard surface-micromachining foundry process and is well-known by those skilled in the art.

In view of the foregoing, it is respectfully requested that the Examiner withdraw the 35 U.S.C. §112 rejection of claims 2-7, 10-12, 15, 16, 24, 28, and 29.

*35 U.S.C. §102 Rejection*

The Examiner has rejected claims 1, 2, 8, 9, 19, and 20 under 35 U.S.C. §102(b) as being anticipated by Ma (U.S. Patent Number 6,531,668). This ground of rejection is respectfully traversed. Reconsideration of this rejection in view of the following comments is respectfully solicited.

With respect to claim 1, the Examiner states that Ma '668 teaches a micro-cantilever device (FIGs. 3a, 3b of Ma) with a base section [22], a cantilever section [220] having a length and a tapered width along the length, the cantilever section connected to the base section [at 90], the tapered width a function of position along the length.

Claim 1 as amended requires that the tapered width have a minimum width proximate the base section as can be seen in FIGs. 1-4 and 9a-9b of the present application. Ma '668 teaches at column 4, line 62, to column 5, line 2, that the cantilever beam 220 is widest at the first end 222 that is fixed to electrical contact 26 by anchor 90 and narrowest at the second end 224 that adjoins a rectangular section 250. Clearly, Ma '668 teaches away from the tapered width having a minimum width proximate the base section. Therefore, Ma '668 does not teach or suggest that the tapered width have a minimum width proximate the base section. In view of the foregoing, it is respectfully requested that the Examiner withdraw the rejection of claim 1.

Claims 2, 8, 9, 19, and 20 depend from claim 1 and are believed to be patentable for the same reasons as claim 1. With respect to claim 2, the Examiner states that Ma '668 shows the function is defined by the tapered width =  $w_0 + ax$ . It is respectfully submitted that with  $w_0$  being the initial width proximate the base section, Ma '668 teaches that the function is actually the tapered width =  $w_0 - ax$  and not  $w_0 + ax$  as required by claim 2.

With respect to claim 8, the Examiner states that Ma '668 shows a ground plane 46 is below a portion of the cantilever section. The Examiner is directed to column 4, lines 1 to 10 of Ma '668 where Ma '668 teaches that a voltage is applied to actuation electrode 46 through bond pad 52 from a voltage source. The voltage sets up an attractive electrostatic force between actuation electrode 46 and the beam 60, which results in the beam deflecting and rectangular section 250 making contact with electrical contact 36. Therefore, it is respectfully submitted

that reference 46 can not be a ground plane because it would render Ma '668 unsatisfactory for its intended use and change the principle of operation of Ma '668.

With respect to claim 9, the Examiner states that Ma '668 shows the micro-cantilever portion has a pull-in voltage that is calculated as a function of the dimensions of the cantilever section and material properties of the cantilever section and refers to column 5, lines 15-21 of Ma '668 for support of this statement. Column 5, lines 15-21 of Ma '668 teach that an advantage of single-taper cantilevered beam 220 over a solid rectangular beam as conventionally used in MEMS switches is that beam 220 has a higher resonance frequency because it has a higher effective spring-constant-to-mass ratio. This means beam 220 can respond to higher-frequency electrostatic actuation, which allows for MEMS switch 200 to perform high-speed switching. No mention or suggestion of pull-in voltage is in column 5, lines 15-21. Ma '668 has been thoroughly reviewed and no teaching or suggestion could be found of pull-in voltage or of pull-in voltage being calculated as a function of the dimensions of the cantilever section and material properties of the cantilever section.

With respect to claim 19, the Examiner states that Ma '668 teaches a micro-cantilever device with a base section 90, a cantilever section 420 having a length and a tapered width along the length, the cantilever section connected to the base section, the tapered width a function of position along the length and a second base section 90 wherein the cantilever is attached to the second base section. It is respectfully submitted that the base sections 90 of Ma '668 are connected to the same surface and therefore cannot form a first and second base section as required by claim 19.

With respect to claim 20, the Examiner states that Ma '668 shows a ground plane 46 that is below a portion of the cantilever section. As previously indicated, the item referenced by reference numeral 46 is an actuation electrode in which a voltage is applied to actuation electrode 46 from a voltage source. The voltage sets up an attractive electrostatic force between actuation electrode 46 and the beam, which results in the beam deflecting. As a result, electrodes 450A and 450B become connected to each other via beam section 424. Therefore, it is respectfully submitted that reference 46 can not be a ground plane because it would render Ma '668 unsatisfactory for its intended use and change the principle of operation of Ma '668.

In view of the foregoing, it is respectfully requested that the Examiner withdraw the rejection of claims 1, 2, 8, 9, 19, and 20.

*35 U.S.C. §103 Rejections*

To establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one skilled in the art, to modify the reference or combine teachings and not based on Applicant's disclosure. See M.P.E.P. 2142. Any proposed modification cannot render the prior art unsatisfactory for its intended purpose or change the principle of operation of a reference. There must be a reasonable expectation of success and the prior art references must teach or suggest all of the claim limitations. See M.P.E.P. 2143. Conclusory statements cannot be relied on when dealing with particular combinations of prior art and specific claims. The rationale for combining references must be put forth. *In re Lee*, 61 U.S.P.Q.2d 1430, 1433. The Examiner can satisfy the burden of showing obviousness of the combination "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references."

The Examiner has rejected claims 3-7, 10-16 and 25-31 under 35 U.S.C. §103(a) as being unpatentable over Ma (U.S. Patent Number 6,531,668). This ground of rejection is respectfully traversed. Reconsideration of this rejection in view of the following comments is respectfully solicited.

Claims 3-7, 10-16 and 25 depend from claim 1 and are believed to be patentable for the same reasons put forth for claim 1.

With respect to claims 3-7 and 25, the Examiner states that it would have been obvious to one having ordinary skill in the art at the time the invention was made to custom tailor the taper function in order to adjust the resonant frequency of the beam. What the Examiner has done is to copy text out of a reference and state that the copied text is the reason that the subject matter of the claims are obvious even though Ma '668 does not teach or suggest any tapered functions. It is respectfully submitted that such a rejection is based on the Applicant's disclosure because the Examiner has not put forth any showing that Ma '668 or any other prior art teaches or suggests the tapered functions. This is prohibited by M.P.E.P. 2142. Furthermore, it is respectfully submitted that the statement is a conclusory statement, which is prohibited by *in re Lee*.

With respect to claims 10-16 and 28-29, the Examiner states that it would have been obvious to one having ordinary skill in the art at the time the invention was made to calculate the pull-in voltage since it was known in the art that the function controlling the cantilever pull-in voltage depends on the cantilever length, taper and material from which

it is constructed. As previously indicated, Ma '668 does not teach or suggest a pull-in voltage. The Examiner has not put forth any showing that the prior art teaches or suggests the claim limitations as required by M.P.E.P. 2143. It is respectfully submitted that this rejection is based on the Applicant's disclosure because the Examiner has not put forth any showing that Ma '668 or any other prior art teaches or suggests the tapered functions. This is prohibited by M.P.E.P. 2142.

With respect to claims 26, 27, 30, and 31, the Examiner states that it would have been obvious to one of ordinary skill at the time the invention was made to determine the pull-in voltage formula of the cantilever depending on its geometry and refers to column 5, lines 15-21 of Ma '668 to support this statement. As previously indicated, column 5, lines 15-21 of Ma '668 teach that an advantage of single-taper cantilevered beam 220 over a solid rectangular beam as conventionally used in MEMS switches is that beam 220 has a higher resonance frequency because it has a higher effective spring-constant-to-mass ratio. No teaching or suggestion of a pull-in voltage could be found in Ma '668. It is respectfully submitted that this rejection is based on the Applicant's disclosure because the Examiner has not put forth any showing that Ma '668 or any other prior art teaches or suggests claimed limitations. This is prohibited by M.P.E.P. 2142.

In view of the foregoing, it respectfully requested that the Examiner withdraw the rejection of claims 3-7, 10-16, and 25-31.

The Examiner has rejected claims 17, 18, and 21-23 under 35 U.S.C. §103(a) as being unpatentable over Ma '668 in view of Sun (U.S. Patent Number 6,307,452). This ground of rejection is respectfully traversed. Reconsideration of this rejection in view of the following comments is respectfully solicited.

Sun '452 teaches an RF switch that is square or rectangular in shape and is not a cantilever type of switch as required by independent claim 1. Therefore, neither Ma '668 nor Sun '452, singly or in combination teach or suggest all of the elements of claims 17, 18 and 21-23 since claims 17, 18, and 21-23 depend from claim 1 and are believed to be patentable for the same reasons put forth for claim 1.

With respect to claim 18, it is respectfully submitted that placement of windows about an axis of symmetry is not a matter of design choice as the Examiner states. As explained in the present specification, stiction of devices is a well-known problem in the fabrication of MEMS devices from surface micromachining and occurs when surface adhesion forces are higher than the mechanical restoring force of the micro-structure. When a device is removed from the aqueous solution after wet etching of an underlying sacrificial layer, the liquid meniscus formed on hydrophilic surfaces pulls the microstructure towards the substrate and

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stiction occurs. While this release-stiction problem may be alleviated by dry HF etching or supercritical CO<sub>2</sub> drying as explained in the specification, in-use stiction may occur during operation when microstructures come into contact. In-use stiction may be caused by capillary forces, electrostatic attraction, and direct chemical bonding. It is respectfully submitted that the placement of a window on the axis of symmetry reduces the effects of capillary forces and the like and is not merely a matter of design choice.

With respect to claim 22, no teaching or suggestion of a strain relief could be found in FIG. 5c of Ma '668 or in the text of Ma '668 or in Sun '452.

In view of the foregoing, it is respectfully requested that the Examiner withdraw the rejection of claims 17, 18, and 21-23.

*Conclusion*

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,

  
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Kevin L. Wingate, Reg. No. 38,662  
LEYDIG, VOIT & MAYER, LTD.  
6815 Weaver Road, Suite 300  
Rockford, Illinois 61114-8018  
(815) 963-7661 (telephone)  
(815) 963-7664 (facsimile)

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